Lastly, Surgeon Ross, R.N., contributes a short paper on the habits of the marine mosquito (*Acartomyia zammitii*).

(2) The second report contains papers on a new species of louse (*Haematopinus stephensi*) which acts as the intermediary host of a new hæmogregarine parasite in the blood of the Indian field rat, by Mr. Christophers and Mr. Newstead; a note on the anatomy of *Gastrodiscus hominis*, a human fluke, by Dr. Stephens; a revision of the Sarcopsyllidæ, by Dr. Karl Jordan and the Hon. N. C. Rothschild, a family of fleas which includes the jigger, and the rat flea supposed to transmit plague to man; and a description of the maiotic process in Mammalia, by Messrs. Moore and Walker. The last-named paper is illustrated with a number of beautiful plates, and is well worthy of study.

(3) In this report the late Mr. Dutton and Dr. Todd, after some general remarks on the conditions favouring the spread of malaria, describe the conditions existing at some of the towns and posts of the Congo Free State, and formulate recommendations for remedying these. Dr. Breinl and Mr. Kinghorn describe experiments showing that the Spirochæta of African tick fever is infective for the horse, dog, rabbit, guinea-pig, rat, and mouse in addition to monkeys, whereas the *Spirochaeta obermeieri* of relapsing fever is infective for monkeys only. Dr. Breinl has also compared the immunity produced by these two Spirochætes, and finds that each strain produces considerable active immunity against re-infection, but does not produce immunity against infection with the other strain. The course of the disease also varies with the two strains, and the conclusion, therefore, is that tick fever and relapsing fever are produced by different species of Spirochætes.

(4) The second report of the Wellcome Research Laboratories of the Gordon College, Khartoum, by Dr. Andrew Balfour, the director, maintains the high standard of the first one (see NATURE, vol. lxxi., p. 605), both as regards the nature of the work recorded and the manner in which it is presented to the reader. Nearly half the volume comprises records of mosquito work in Khartoum, of biting and noxious insects, mosquitoes, and other human, animal, and vegetable pests of the Sudan. Dr. Balfour describes a hæmogregarine parasite of the jerboa and a leucocytozoon of mammals, and contributes a report on cattle and equine trypanosomiasis in the Anglo-Egyptian Sudan. Fortunately, human trypanosomiasis and sleeping sickness do not yet seem to be endemic in this part of Africa, nor has the tsetse-fly which conveys it (*G. palpalis*) been described here. In the chemical laboratory a considerable amount of work has been done by Dr. W. Beam, the chemist, on water analysis, Sudan grains and gums, &c. The travelling naturalist, Mr. Sheffield Neave, records many interesting observations on blood, blood parasites, &c., of birds, fish, and other animals.

R. T. HEWLETT.

PRESIDENTIAL ADDRESSES AT THE NEW YORK MEETING OF THE AMERICAN ASSOCIATION.

A GENERAL article upon the proceedings of the American Association for the Advancement of Science at the meeting held at New York during the Christmas vacation appeared in NATURE of January 24 (p. 304). Through the kindness of the general secretary of the association, Dr. L. O. Howard, we have received copies of several of the addresses delivered by the president and by the chairmen of sections, but limitations of space will not permit us to publish any of them in full. The subjoined extracts from these addresses will, however, afford an indication of the subjects considered and the views expressed.

EDUCATIONAL THEORIES, ANCIENT AND MODERN.[1]

The Greek idea of education and culture was based upon the existence of a privileged class, fed, clothed, and sheltered by the labour of slaves—a real aristocracy devoted to war, art, literature, and luxurious living. The sway of the so-called classic idea of education has been, and still is, one of the marvels of history. The splendour of Greek art, the brilliancy of Greek literature, and the keenness of Greek logic, have held the world as in a trance, unable to break away from its charms—though it has been unsuited to other peoples and other social conditions.

Francis Bacon more than any other man showed the inadequacy of the classic method, fine as it was along certain lines, and the comparative worthlessness of scholasticism, and he opened the eyes of the educated people of his time to the wealth of opportunity for interesting and profitable study in the great laboratory of nature, and, better than all else, he set forth the dignity and intellectual value of science study, and vigorously scouted the idea that the usefulness of scientific truth in any degree detracted from its educational value.

But none of the writers touching on education, with the possible exception of Froebel and Pestalozzi, not even Locke, Milton, or Dr. Samuel Johnson, looked at the matter from the scientific standpoint, which takes into account, first, the physiological laws which govern the growth and development of the brain; secondly, the exterior stimuli for promoting that growth most successfully; and, thirdly, the kind and quantity of knowledge and skill one must have in order to meet most completely the demands of a carefully selected occupation.

Every good teacher aims to make his subject as interesting as possible to his pupils. If they fail to take a lively interest in it, something is wrong; either it is not properly presented, or it is over their heads, or it is clearly of no earthly use. Natural lack of capacity on the part of the child is rarely a valid reason for failure if the child be healthy and normal. I have learned to discredit the truth of the oft-told tale that "John has no capacity for" such a subject—mathematics, for example. "He never could learn mathematics—he takes no interest in algebra, and he hates geometry," &c. Our higher schools and colleges are full of young people who protest vigorously that they never could, and never can, understand or take any pleasure in or gain any profit from certain studies. I firmly believe that every normal person, at least nine out of ten of the children and youth at school and college, can fairly master and actually enjoy and profit by, not only mathematics, but by every subject in the curriculum if it be properly taught, and under proper conditions as to age and preparation.

Attention is as necessary to the growth and development of the brain as exercise is to the development of a muscle, and interest is the condition of a lively attention. When in a school or lecture-room the limit of close attention is reached, the lesson or lecture should close, for the educational process has already stopped. It is not only useless, but it is worse than useless, to go on when the class or audience refuses for any reason to attend. I therefore doubt the educational value of subjects which are not, and perhaps cannot be, made interesting.

Of course I do not claim that all selected studies can be made equally interesting, or that any one study can be made equally interesting to all pupils, even when the pupils are properly graded, but I do claim that a lively interest is necessary, and that educational progress is very nearly proportional to the strength of that interest.

Perhaps the most valuable contribution to the science of education has come through a study of the laws which obtain in the growth and development of the brain, and the conditions under which that growth and development is most healthy and complete. There are times and seasons for the development of the mental and moral faculties as there are of the physical faculties. While such times and seasons are not precisely the same for all children, we find that all attempts at premature development are not only worthless, but are permanently injurious. Precocity is now regarded as a species of brain deformity. Plants and animals may be forced, and unusual and interesting results may be produced by forcing, but no one of us wishes a son or a daughter to be a prodigy in one direction at the cost of normal development in other directions.

The psychologists tell us that the brain cells develop as do other physical organs, not only through thought, but through muscular activity and the exercise of our senses. Accordingly, a healthy and timely growth and development of the brain is to be promoted by an education involving a great variety of activities, skilfully adjusted as to quality and quantity to the mental and physical status of the child.

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[1] From an address delivered by Prof. C. M. Woodward, president of the American Association.

Closely related with this of brain culture is the subject of manual training, which has recently gained a foothold in our scheme of rational education. Its nature and educational value are still under discussion.

The manual-training movement stands inevitably as a criticism upon the system of education which came down the ages through the fathers to us, and naturally the latter stands on the defensive. It also is a standing reproof to the old wasteful, unscientific method of teaching apprentices the theory and uses of tools. It is for educational science to justify the ways of progress, which lays aside the idols of the past and erects new temples and opens new kingdoms. Of all the temples, none is finer, none is more glorious, and none should be more scientifically planned and reared than education.

The evolution of the fully fledged technical school, or the technical department of the university, has taken place during the last half-century, and yet its broad, stimulating, attractive features have a following which bids fair to double the attendance of college and university students. This does not mean that letters and polite learning are being neglected, but that a new constituency is eager for the new education. This new education, though it recognises at all points a high order of usefulness, and contains little that is conventional, is only remotely professional. If ever its curriculum becomes narrow, it is quickly condemned by the best representatives of an education which combines utility with culture. No longer can the "Levites of culture," as Huxley calls them, claim to monopolise liberal education. The new education can be as liberal as the old, and both can be narrow. Fortunately, they flourish side by side, and the future shall choose the excellences of each. An adequate science of twentieth-century education will evaluate the characteristics of each, and bring the wisdom of the past, not its foolishness, to nourish the wisdom of the future.

Accuracy of Astronomical Clocks.[1]

The accuracy with which our astronomical clocks perform their function is a subject of interest. The earliest star catalogue of precision is that of Bradley. In discussing the performance of his clock, I have used the adopted rates as given by Auwers in his re-reduction of Bradley. The monthly means of the rates from July, 1758, to July, 1759, were taken, and the difference of each rate from its monthly mean. Then the mean of these differences, without regard to sign, was taken for each month.

The rates of two other clocks of the Greenwich Observatory were likewise discussed, the standard clock for the year 1850 and that for 1900, the adopted daily rates as published in the annual volumes being used. The first of these was kept in the observing room, and thereby subjected to large variations of temperature, while the second, made in 1871 by E. Dent and Co., was fixed to the north wall of the magnetic basement, as in this apartment the temperature is kept nearly uniform. The pendulum of this latter clock is provided with barometric as well as thermometric compensation.

There are two well-known clocks which should be mentioned, and in conclusion I will give some hitherto unpublished data concerning the clock with which I have been working during the past three years.

Probably no clock has had its rate more thoroughly discussed than Hohwü No. 17, the standard clock of the observatory at Leyden. It was set up in the transit room in 1861, and in December, 1898, was removed to the large hall of the observatory, where, enclosed in two wooden cases, it was placed in a niche cut in the pier of the 10-inch refractor. Further, to guard against sudden changes of temperature, the niche is closed by a glass door. At the meeting of the Royal Academy of Sciences at Amsterdam, held September 27, 1902, Dr. E. F. van de Sande Bakhuyzen submitted a formula as the best representation of the daily rate of the clock, and gave the result of a comparison of the observed daily rates 1899–1902, the average interval of time for each rate being six days, with those computed by means of the formula. I find that during the year 1900 the mean of these differences is 0·028s., and the largest difference is 0·071s.

About 1867, F. Tiede installed at the Berlin Observatory a weight-driven clock enclosed in an air-tight case. The original escapement was replaced in 1876 by a gravity escapement, and the clock continued to give satisfaction certainly up to 1902, when it was dismounted for cleaning. The only published rates that I have been able to secure are those during twelve weeks in 1877–8. During this period the average deviation of the observed daily rates, the average interval for each rate being six days, from the mean daily rate for the entire period is 0·030s.

In 1903 there was installed at the U.S. Naval Observatory one of Riefler's clocks, No. 70, with a nickel-steel pendulum, the impulse being communicated to the pendulum through the suspension spring. This clock was enclosed in an air-tight glass case, and was mounted in a vault where the temperature was artificially controlled. The definitive rates have been determined from September, 1903, to May, 1904, but, unfortunately, during this entire period we were unable to prevent the glass case leaking, and there was a variation of temperature in the vault of about 5° C.

Collecting together the results obtained, we have:—

Mean Deviation of Daily Clock Rate.

Clock	Date	Mean Deviation
Bradley	1759 ...	0·102
Greenwich Observatory ...	1850 ...	0·149
Greenwich Observatory ...	1900 ...	0·051
Berlin Observatory	1877 ...	0·02–0·03
Leyden Observatory	1900 ...	0·028
U.S. Naval Observatory ...	1904 ...	0·015

Fact and Theory in Spectroscopy.[1]

Any treatment of the production of radiation falls more or less naturally into three parts, namely:—(1) the radiation of solid and liquid bodies which is almost, but not quite, independent of atomic structure; (2) the radiation which takes its rise in radio-active substances, and which is apparently dependent upon atomic collapse; and (3) the radiation of gaseous substances, dependent almost entirely upon normal atomic structure, and possibly also upon the mode of excitation.

The subject to which consideration is now invited has to deal only with radiation of this third class. Radiation which in terms of the electron theory is said to be due, not to abrupt or discontinuous acceleration, but to periodic acceleration.

Briefly defined, spectroscopy is that science which has for its object the general description of radiation, including the production of radiation, the analysis of radiation, the registration of radiation, and the measurement of radiation.

The theory of separating, recording, and comparing radiation is by no means simple or complete. That these last three operations demand in practice the highest degree of skill is exemplified by the work of Rayleigh, Rowland, Michelson, Perot and Fabry, and Hale.

There is, however, a certain very true sense in which these last three processes are merely preparatory to a more profound study of the first, namely, the production of radiation. From this point of view, spectroscopy hinges upon the radiant atom—if there be an atom—and may be defined, imperfectly and narrowly perhaps, as *the science of the radiant atom.*

More than one brilliant and partially successful attempt has been made within the last quarter-century to establish an adequate foundation for this science by devising what may be called a satisfactory atom. But before considering any of these attempts, it may be well to state briefly what seems to be the criteria by which any such foundation is to be judged.

Perhaps it may be fair to consider that atom as most competent which will explain satisfactorily the largest number of the following nine facts:—

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[1] From an address delivered by Prof. W. S. Eichelberger chairman of the Section of Mathematics and Astronomy.

[1] From an address delivered by Prof. H. Crew, chairman of the Section of Physics.

(1) The fact that spectral lines are in general approximately sharp.

(2) The fact that spectral lines are never perfectly sharp, but always have a finite physical width.

(3) The fact that certain spectral lines are arranged in series and bands after the manner described so perfectly by Balmer's equation and its generalised forms.

(4) The fact that increase of pressure causes a shift of spectral lines toward the red, as discovered by Humphreys and Mohler.

(5) The fact that a magnetic field will transform single lines into multiple polarised lines, as discovered by Zeeman.

(6) We come now to a group of phenomena which are not easily described under a single caption. I refer to phenomena such as those observed by Plücker and Hittorf, when they found one and the same gas in one and the same tube yielding very different spectra according to the mode in which the electric discharge was applied to make the gas luminous. In the same category doubtless belongs the extinction of air lines by the insertion of self-induction into the discharge circuit. Here may belong also the fact studied by Lenard and others, that the region near the electrode of an arc gives a spectrum different from the region near the centre of the arc; the fact also that the so-called "spark lines" are introduced into an arc by reducing the current to small values, a fact first studied by Hartmann.

Certainly in this same category belongs the fact that the spectrum of an arc is modified when the arc is surrounded by an atmosphere different from ordinary air.

Here also lie the profound differences between arc and spark spectra of the same element.

Notwithstanding the fact that "multiple spectra" is a term which has hitherto been employed to describe the Plücker tube variations, I propose that we generalise it and use it to describe this entire group of facts. Since the name is so appropriate, let us call the sixth fundamental phenomenon that of "multiple spectra."

(7) Any competent atom must allow us to infer the relations which have been proved to exist between spectral phenomena and atomic weights.

(8) The phenomena of line reversals and absorption bands.

(9) The fact that heat alone, at least within the range of our highest artificial temperatures, produces characteristic spectra in only a few rare instances.

These, briefly, are the parts of the spectroscopic superstructure for which a foundation is sought. These are the various parts which it is hoped will, some day, be cemented together, by a simple and general theory, into a harmonious structure.

But there is a final criterion, even more fundamental than any of those which have been mentioned, that such a theory must satisfy, namely, this hypothetical radiant atom must not in its behaviour, except as a very last resort, contradict any of the established principles of physical science, be they mechanical, electrical, or chemical.

The principle of the conservation of energy must be satisfied, even if it is necessary to assign an undreamed of amount of energy to each atom; in like manner Newton's third law is to be satisfied, even if the electromagnetic ether is called upon to furnish the reaction.

But even with this added criterion, the preceding list of nine phenomena is confessedly incomplete; the only object of such a catalogue is to include those typical fundamental facts which ought, apparently, to follow as immediate consequences from the structure of the radiating body, so soon as that structure is correctly guessed. Thus Doppler's principle is omitted on the ground of its being rather a kinematic law, governing periodic disturbances in any medium than a dynamical fact to be explained in terms of atomic structure and forces.

Having established a set of criteria by which we may estimate the fitness of a radiant atom, it would be interesting, if I were competent, and if time permitted, to pass in review some of the various atoms which have been proposed in recent times, such as that of Kelvin, 1884, or those suggested by the Hertzian oscillator.

But neither of these two conditions are fulfilled, and I propose, therefore, to consider only one atom, namely, the one which by common consent, I think I may safely say, more nearly satisfies the demands of experimental fact than any other ever devised. I refer to the atom first proposed in a general way by Lord Kelvin in his paper entitled "Epinus Atomised" (Baltimore Lectures, p. 541, Cambridge, 1904), and afterwards profoundly modified by Lorentz, Thomson, and Larmor.

So much work along this line has been done in the Cavendish Laboratory that one feels impelled to call this "the Cambridge atom"; in view, however, of its structure, perhaps "the Saturnian atom" is a more appropriate designation.

THE CONTRIBUTIONS OF AMERICA TO GEOLOGY.[1]

In speaking of the contributions of America to geology, I do not propose to give an inventory of the geological facts which have been made known as the result of work in this country. I propose rather to ask the question, "What has our country contributed to the stock of geological ideas?" In that classical history of geological science which Lyell has given us in his "Principles of Geology," he directs attention to the fact that the share which different nations bore in the early development of geological science was dependent, not alone upon the genius of individual workers, but in large measure upon the peculiar geological conditions of the various countries in which they worked.

Of course, it must be admitted that there is to-day no department of geological science which is as characteristically American as mineralogy was German, as dynamical geology was Scotch, as stratigraphical geology was English, and as palæontology was French, a century ago. I believe, nevertheless, that there have been certain contributions to the stock of geological ideas which are characteristically American.

The doctrine of the permanence of continent and ocean —the gradual emergence of continental lands and the withdrawal of the waters into the deepening ocean basins—was first enunciated by Dana in 1846. It was, apparently, the thought of the subsiding ocean bottom rather than the thought of the emerging land by which Dana was first led to the doctrine of the permanence of continent and ocean, but in his presidential address before the American Association for the Advancement of Science in 1855, Dana refers to the stratigraphy of New York as illustrating the idea of continental emergence. The doctrine of the permanence of continents when announced by Dana was essentially a new one. Geologists and pseudo-geologists of all classes had felt at liberty to re-distribute continents and oceans according to their own sweet will.

There is now little doubt that Dana was right in his general conception. The greater density of the suboceanic masses in comparison with the subcontinental masses, as shown by pendulum observations, indicates that the distinction between continent and ocean has its basis in the heterogeneity of the material in the interior of the earth, and the determining conditions must therefore have had their origin in the initial aggregation of that part of the primitive nebula which formed the earth.

Certain it is, however, that Dana made the evolution of the continents too simple an affair. He recognised, indeed, that the progressive emergence of the continental lands was attended by continual oscillation, yet, even in the last edition of his "Manual," it appears that he did not duly appreciate the magnitude of those oscillations. The doctrine of the progressive evolution of continents, as taught by Dana, gave new clearness and emphasis to the general conception of geology as a history of the globe.

The Geological Survey of Pennsylvania made known the folded structure—the alternate anticlines and synclines—of the Appalachians. The beautiful sections of these folded strata, in the atlas of that survey, reveal the thoroughness with which the structure of the mountains was investigated by Henry D. Rogers.

While the stratigraphy was worked out so beautifully in the first geological survey of Pennsylvania, the dynamic conception derived from it was crude indeed. But, however completely the Pennsylvania geologists failed to construct a satisfactory theory of mountain-making, their observations of Appalachian structure were of immense value in their destructive effect upon some of the notions of mountain-making prevalent at the time.

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[1] From an address delivered by Prof. Wm. North Rice, chairman of the Section of Geology and Geography.

The true interpretation of the Appalachian waves is probably to be found in the contractional theory of mountain elevation, of which Dana was the leading expounder. That the main cause of mountain elevation is tangential pressure in the crust resulting from internal contraction is now generally acknowledged, though there may be doubt whether the main cause of contraction is the cooling of the earth from an incandescent condition.

It is a curious fact that the first published suggestion of the agency of ice in connection with the drift came from a cotton manufacturer in Connecticut, Peter Dobson by name. The credit of the introduction and championship of the glacier theory of the drift belongs, not to a native, but to an adopted citizen of this country. In the early papers of Agassiz, the conception of the Glacial period took a form which he himself later recognised as an exaggeration. He conceived at first a fall of temperature so widespread that a polar ice-cap extended southward over the whole breadth of Europe and across the Mediterranean, reaching the Atlas Mountains. Later he recognised the ice-sheet that covered the Alps as entirely separate from the ice-sheet of northern Europe. The tendency to an exaggerated view of the Glacial period overcame him again in later years, when he maintained that, at the climax of the Glacial period, there was "floating ice under the equator, such as now exists on the coasts of Greenland." As Agassiz travelled in various parts of his adopted country, he recognised everywhere in the northern States the traces of glaciation, already familiar to him in Switzerland and in Scotland.

Within the last few decades the labours of earnest and able investigators have developed the glacier theory more in detail, and have added vastly to our knowledge of Quaternary history. The imaginary polar ice-cap has given place to ice-sheets of more limited dimensions, though still vast. The series of terminal moraines, marking stages of re-advance or halts in the retreat of the ice-sheet, have been carefully mapped.

In early years the study of geology in this country was substantially confined to the region east of the Mississippi, but, in due season, the weird and fascinating region of the Cordillera revealed itself to explorers and geologists. It is now more than half a century since American geologists began the study of that western wonderland. The first lesson that geologists learned in that land was the efficiency of subaërial denudation to remove vast quantities of material and shape the topography of wide areas. That western land has taught us, not only to recognise the fact of subaërial denudation, but also to formulate its methods. In Powell's "Exploration of the Colorado River," he distinguished rivers as consequent, antecedent, and superimposed. Davis has carried the analysis somewhat further, giving us subsequent and obsequent rivers. Powell formulated the doctrine of base-levels; Davis has given the conception greater accuracy and consistency by distinguishing base-level from profile of equilibrium. To Davis also we owe the full development of the conceptions of youth and age in river valleys and in drainage systems, and of cycles of erosion ending in the formation of peneplains.

Half a century ago the exploring expeditions connected with the Smithsonian Institution began to collect fossils from the Tertiary deposits of the western plains. Over those western plains were found to stretch vast continental deposits, certainly not all of lacustrine origin. These continental deposits of the western plains yielded in unparalleled richness mammalian fossils, which have been studied by Leidy, Marsh, Cope, Osborn, Scott, Wortman, and others. No other single series of discoveries has been so potent in changing the bearings of palæontology upon the doctrine of evolution.

In the half-century since the publication of Darwin's first edition, the attitude of palæontologists has completely changed. Not only is it true at present that palæontologists are substantially unanimous in accepting the doctrine of evolution, but it has come to be generally believed that the very science which afforded a half-century ago the strongest objection to evolution now affords its strongest support.

When the first edition of the "Origin of Species" was published, the classes of birds and reptiles seemed to stand widely asunder. But in the very next year (1860) an odd feather of Archæopteryx was discovered, and a year later the skeleton now preserved in the British Museum; but Archæopteryx was a solitary representative of the birds of markedly reptilian character until the discovery of Ichthyornis and Hesperornis in the Cretaceous of Kansas, of which preliminary descriptions were published by Marsh in 1872.

But the discoveries of most evolutionary significance, as already intimated, have been among the Tertiary mammals. A number of series has been traced, leading from generalised types in the Eocene, through forms of gradually increasing specialisation, to genera which still survive.

SOME PHASES OF PREHISTORIC ARCHÆOLOGY.[1]

Are eoliths artifacts? This is the fateful question. Their geological age is of no consequence if they are only natural forms, and have never been used by man or his precursor. The first flakes to be utilised were in all probability natural forms. It is not likely that Eolithic man knew how to obtain the raw material from the chalk. He depended on picking up from the drift flakes of approximately the shape and size needed. A sharp edge was utilised once, twice, or until it became dulled, and was then cast aside. If an angular piece did not admit of being comfortably grasped in the hand, the troublesome corners were removed. Such conclusions as these are forced upon one after careful examination of a series of the specimens in question. Would the same conclusions be so irresistible if these objects were merely nature's playthings? Many may even be grouped according to more or less definite patterns. Two of these deserve special mention, viz. the small crescent-shaped scrapers comparable to the spoke-shave, and the double scrapers with an intervening point between the two scraping edges. Sometimes two margins are worked, but on opposite sides. That is to say, after chipping one of the margins, instead of rotating the specimen until the adjacent margin comes into play, it was reversed.

The wide differences of opinion as to the origin of eoliths can hardly be due to prejudice alone. Faulty or insufficient observation and incorrect interpretation doubtless play their part. Luckily, there is no disposition to drop the matter until the truth appears. At the International Congress of Anthropology and Prehistoric Archæology held at Monaco April 15–22, 1906, the chief subject of the second session was the pedigree of the eolith. According to NATURE (June 28, 1906, p. 211), "a series of mill-modelled flint nodules was exhibited, among which there was certainly a number closely resembling many Prestwichian types, but conspicuous by their absence were the decidedly purposeful and rationally usable Kentian forms." On the other hand, Prof. E. Ray Lankester "submitted that he had recently placed on exhibition in the British Museum a considerable series (*Amer. Anthropol.* (N.S.), 1905, vii., 432, 433) of specimens selected from Prestwich's collection, all borer-like in form, too identical in shape and so rationally of obvious utility for any possibility of their being the result of fortuitous natural collisions."

As a further indication of the importance attaching to a correct solution of the problem, and indirectly in recognition of the value of Rutot's contribution toward such a solution, the meeting of the German Anthropological Association for 1907 will be held in Cologne in order that the members may visit the eolithic stations of Belgium and see the collections of the Brussels Museum.

Of caverns with Palæolithic mural decorations outside France, thus far reported, one is in Italy and four in Spain. The most important cavern in the Spanish group is that of Altamira, in the north coast province of Santander, this being the one in which the discovery of mural figures first took place. The genuineness of these figures would have continued to remain in doubt had it not been for similar subsequent discoveries elsewhere.

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[1] From an address delivered by Prof. MacCurdy, chairman of the Section of Anthropology.

M. Émile Cartailhac and the Abbé H. Breuil have recently studied with great care the wall paintings and engravings at Altamira. The cavern is a series of large chambers connected by passage ways. There is no evidence of its having been occupied by either man or beast since the close of the Quaternary, at which time the entrance was completely closed by a fall of earth and stones.

A second recent fall has afforded a new opening to the cavern, reached by clambering over the débris that closed the original entrance. The first chamber is divided by means of a mass of fallen stones. The one on the left is 40 metres long by 20 metres wide. The one on the right is a sort of corridor connecting with other chambers. Industrial remains of the floor deposits are confined to the entry and the chamber on the left. There is evidence that the cave bear had occupied the cavern before man took possession. Figures, engraved or painted, are found on the walls of every part of the cavern, especially on the ceiling of the chamber on the left, near the entrance, where the frescoes are remarkable for their beauty, size, and good preservation—a sort of Sistine chapel representing the *chef d'oeuvre* of perhaps more than one Michael Angelo of that far-off time.

These works of art represent a variety of technique. Some are simple line engravings. Others are more deeply incised. But the engravings are not so numerous as the figures represented in colour. Many are done in a single colour, either red or black. The most remarkable are the polychrome frescoes similar to those of Font-de-Gaume already described.

The figures are not all animal representations. Many are signs, the significance of which is not known. They do not belong to a single epoch. The superposition of figures, each in a different technique, studied in connection with the relative state of preservation of the various figures, has furnished a key to the order of succession. The same succession is traceable in the caverns of France, so that the Abbé Breuil and his colleagues, MM. Cartailhac, Capitan, Peyrony, and Bourrinet, have been able to distinguish four distinct phases[1] in the evolution of mural painting and engraving, all of them being represented in the cavern of Altamira.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Cambridge.—The following Graces passed the Senate at Congregations held on February 1 and 2:—(1) That, in accordance with recommendation i. contained in the third report, dated November 13, 1906, of the special board for mathematics on the mathematical tripos, the regulations for the mathematical tripos, part i., contained in the report, be approved (placet, 776; non-placet, 644). (2) That, in accordance with recommendation ii. of the same report, the regulations for the mathematical tripos, part ii., contained in the report, be approved (placet, 780; non-placet, 638). (3) That, in accordance with recommendation iii. of the same report, the temporary provisions for the mathematical tripos, alike under the old regulations and the new regulations, contained in the report, be approved (placet, 777; non-placet, 637).

The Adams prize for 1907 has been awarded to Dr. E. W. Brown for his essay on "The Inequalities in the Moon's Motion due to the Direct Action of the Planets."

Mr. Douglas W. Freshfield will deliver a public lecture on Ruwenzori, at the Sedgwick Museum, on Thursday, February 14. The lecture will be illustrated by lantern pictures, including many taken during the Duke of the Abruzzi's expedition.

The special board for biology and geology has nominated Mr. C. Shearer, Trinity College, to use the University table at Naples for three months from March 1.

Mr. Francis Galton, F.R.S., has given a further sum of 1000*l.* to the University of London in aid of the study of national eugenics founded under his previous benefaction. Mr. David Heron has been appointed Galton research fellow in national eugenics, in succession to Mr. Edgar Schuster, resigned.

Sir Cowasjee Jehanghir Readymoney has, says the *Times*, offered to the Bombay Government the sum of $2\frac{1}{2}$ lakhs of rupees (16,666*l.*) for the erection of a university examination hall in Bombay, thus following the munificent example of his father in giving to the city the Elphinstone College buildings and the Senate hall of the University.

The annual general meetings of the Association of Technical Institutions will be held at the Clothworkers' Hall, Mincing Lane, E.C., on Friday and Saturday, February 8 and 9, as follows:—on Friday afternoon the presidential address will be delivered by Sir Horace Plunkett, K.C.V.O. On Saturday morning the following papers will be read and discussed:—the cooperation of adjacent authorities in the supply of higher technical education, Principal A. F. Hogg; monotechnic institutions, Mr. Charles Harrap.

Sir A. B. W. Kennedy, president of the Institution of Civil Engineers, speaking at a dinner given by the Carpenters' Company on Monday to a number of eminent members of the engineering profession, remarked that the idea of thirty or forty years ago that the training of an engineer should be specialised has passed away. It is now recognised by all engineers that their profession is one at bottom, and that therefore an engineer should have a thorough general training in scientific work which should be the basis of all his future work, and that he should only specialise when it is necessary to do so to earn his daily bread.

The inaugural lecture to the courses on Japanese education, to be delivered under the Martin White benefaction in the University of London by Baron Dairoku Kikuchi during the spring and summer terms, will be given at the University, South Kensington, on Thursday, February 14, at 5 p.m. Sir Edward Busk, Vice-Chancellor of the University, will preside. Admission to the inaugural lecture will be free by ticket, obtainable on application to the academic registrar at the University, South Kensington. Arrangements have been made for a course on Japanese educational administration to be delivered at the London School of Economics, and for courses on Japanese educational methods, to be delivered at University College, Gower Street, and King's College, Strand.

The annual court dinner of the Leeds University was held on Thursday, January 31, and was attended by His Excellency Baron Komura, the Japanese Ambassador to this country, as the chief guest. Among those present were the High Sheriff of Yorkshire, the mayors of many neighbouring boroughs, representatives of various education authorities, technical institutions, grammar schools, and other bodies. Baron Komura, in proposing the toast of the University, referred to the debt of gratitude which Japan owed to the educational institutions of England, and among them to the University of Leeds, which has numbered a good many young Japanese among its students. Since the granting in 1904 of the Charter establishing the University, a new capital fund has been raised by private donations which now amounts to 82,300*l.* New buildings are in progress to accommodate the department of mining and metallurgy, and other important extensions rendered necessary by the growth of numbers in the University are under consideration.

The council of the University of Manchester has decided to institute two new lectureships, one in economic zoology and one in economic botany. The lectureship in economic zoology will provide further instruction in special subjects for the senior and honours classes in zoology, and the lecturer will devote a portion of his time to the preparation of reports on animal parasites and pests. An important part of the duty of the new lecturer will be to conduct research on such subjects as the fauna of reservoirs and sewage conduits, the life-history of animal parasites, and on other matters of economic importance. The lecturer in economic botany will give instruction to

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[1] A fifth and closing phase is discernible at Marsoulas, resembling somewhat the work on the painted pebbles of Mas d'Azil.